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1 Navy Case 77595

2 SITE-CONTROLLED LOCKING DEVICE

3 SPECIFICATION

4 Background of the Invention

5 This invention relates generally to locking devices and  
6 more specifically to locking devices for transportable  
7 containers.

8 There are many instances when a transportable container,  
9 such as, for example, an attache case, or a freight car,  
10 needs to be moved to another location. The container is  
11 often locked to prevent it from being opened *en route* and to  
12 guard against theft of its contents. There are many kinds of  
13 locking devices that can be used to lock the container. Key  
14 locks require a key to be opened. Combination locks are  
15 opened by turning a dial to a correct combination of numbers.  
16 All of these locks suffer from the disadvantage that they can  
17 be opened while the container is *en route* by a thief who  
18 finds the key or learns the combination. The theft may not  
19 be discovered until much later when the container arrives at  
20 its destination.

21 Summary of the Invention

22 It is therefore one object of the invention to improve  
23 locking devices.

24 It is another object to provide a locking device that  
25 cannot be opened except at a site at which it has been set to  
26 be openable.

1           These and other objects of the invention are achieved by  
2 a locking device comprising a normally closed lock having  
3 means for opening the lock. The locking device also includes  
4 means for disabling the opening means except when the lock is  
5 located at a preset site.

6           In another aspect, the invention involves a locking  
7 method comprising the steps of closing a lock having opening  
8 means therefor, and disabling the opening means except when  
9 the lock is located at a preset site.

10          The locking device has the advantageous result that when  
11 used in combination with a transportable container the  
12 locking device can be set to be openable only when the  
13 container has arrived at its destination. In addition, the  
14 locking device cannot be opened while the container is en  
15 route to its destination.

16          Additional advantages and features will become apparent  
17 as the subject invention becomes better understood by  
18 reference to the following detained description when  
19 considered in conjunction with the accompanying drawings  
20 wherein:

#### 21                   Brief Description of the Drawings

22          FIG. 1 is a perspective view of a transportable  
23 container with an embodiment of the locking device mounted  
24 thereto.

25          FIG. 2 is a front view of the locking device of FIG. 1.

26          FIGS. 3a, 3b, 3c, and 3d are diagrammatic cross-sections

1 through the locking device of FIG. 1 showing steps in its  
2 operation.

### 3 Detailed Description

4 Referring to the drawings, wherein like reference  
5 numerals designate like or corresponding parts throughout the  
6 several views, the FIGS. illustrate one embodiment of a  
7 locking device according to the invention. The locking  
8 device 11 may be used in combination with a transportable  
9 container 13 as shown in FIG. 1. The locking device 11  
10 includes a normally closed lock 15 which seals the container  
11 13. The lock 15 has a means for opening the lock that is  
12 contained in a housing 17 mounted on the container 13. The  
13 locking device also includes a means for disabling the  
14 opening means except when the lock is located at a preset  
15 site. The disabling means is also contained in the housing  
16 17. While the lock 15 and the opening means may take a  
17 variety of forms, conveniently the lock 15 may have a locking  
18 bolt 19 engaging a bolt-receiving locking block 21, and the  
19 opening means may include a D.C. motor 23 connected to the  
20 bolt 19 for moving the bolt back and forth, and input means  
21 25 for receiving and supplying power from a battery to the  
22 motor 23. A control panel 27 is provided in the housing 17  
23 for activating the opening means. The disabling means may  
24 also take a variety of forms. Conveniently, it may take the  
25 form of a Global Positioning System (GPS) receiver 29 and a  
26 relay 31 which has isolated input and output circuits. A GPS

1 receiver is a device for continuously tracking and using a  
2 constellation of satellites orbiting the earth at a very high  
3 altitude to compute and update the position of the receiver.  
4 GPS receivers are well-known devices for which a fuller  
5 description is not considered to be needed. One example of a  
6 GPS receiver is described in U.S. Pat. No. 4,785,463, whose  
7 disclosure is hereby incorporated by reference. A preferred  
8 GPS receiver 29 is the Model GPS 65 Personal Navigator sold  
9 by GARMIN International of Lenexa, Kansas, and described in  
10 their Model GPS 65 User Manual, the disclosure of which is  
11 also incorporated by reference. The GPS receiver has a  
12 memory for storing the coordinates of a preset site and means  
13 for comparing the coordinates of the receiver with those of  
14 the preset site and outputting an alarm voltage signal when  
15 there is a match. The GPS receiver 29 is contained in the  
16 input circuit of the relay 31, and the alarm signal from the  
17 GPS receiver functions as the control signal for the relay.  
18 The motor 23 and the input means 25 for receiving and  
19 supplying power from the battery are contained in an output  
20 circuit of the relay 31.

21 Briefly, the operation of the locking device 11 starts  
22 with the lock in its open state and includes the steps of  
23 storing the coordinates of a preset destination, closing the  
24 lock, and disabling the opening means. The lock is now in  
25 its normally closed state. To restore the lock to its open  
26 state, the operation of the locking device includes the steps

1 of moving the lock to the site of its preset destination,  
2 comparing the coordinates of the lock and preset destination,  
3 enabling the opening means, and opening the lock. The  
4 operation of the locking device 11 will now be described in  
5 more detail.

6  
7 1-LOCK IN OPEN STATE - See FIG.3a  
8

9 With the locking bolt 19 in its open, withdrawn from the  
10 locking block 21, position, battery power available at  
11 terminals 25 is turned on at the control panel 27 by  
12 activating a pushbutton power switch 33 and so closing  
13 normally-open contacts 35. The power-on condition is  
14 confirmed by a Power On light 37.

15 Also confirmed after the locking device power is  
16 switched on, is the status of the locking bolt 19 in the  
17 unlock position by a Control Unlock light 39 as a result of  
18 the engagement of a switch-engaging arm 41 of the translating  
19 bolt support block 43 with a limit actuating switch 45, thus  
20 closing normally-open contacts 47. The bolt support block 43  
21 is capable of translation between lock and unlock position  
22 limits by means of a rack and pinion gear assembly 50, driven  
23 by the D.C. motor 23 through a gear reduction drive (not  
24 shown).

25 Note that this engagement of the arm 41 with the switch  
26 45 has also opened normally-closed contacts 49 and assures

1 keeping electrical power from the D.C. motor 23 and so  
2 preventing the motor from continued operation after the bolt  
3 support block 43 reaches the unlock limit position. Use of  
4 the gear reduction drive (not shown) with the D.C. motor 23  
5 provides the useful features of assuring sufficient torque  
6 for lock operation and assuring sufficient reverse driving  
7 gear train friction which serves to prevent the motor shaft  
8 from being rotated and, consequently the bolt moved, by means  
9 other than by provision of electrical power to the motor.

10 With locking device power on, the GPS receiver 29 is  
11 then turned on and destination data is entered into the GPS  
12 receiver using its own panel display and controls 30, after  
13 which the GPS receiver is turned off and the entered  
14 destination data is stored and retained in memory by means of  
15 the GPS receiver's own internal low-power, long-life battery.  
16

17 2-TRANSITION TO CLOSED STATE - See FIG.3b  
18

19 The locking bolt 19 can then be driven into the bolt-  
20 receiving block 21 (the lock position) by moving the arm of  
21 the toggle switch 51 on the control panel 27 from its normal  
22 center-off position to the lock position. This toggle switch  
23 action provides D.C. power of the correct polarity to the  
24 motor 23 by closing normally-open contacts 53 and 55.

25 Provision of power to the motor 23 is also enabled by  
26 the previous closure of normally-closed contacts 57 of a

1 limit actuating switch 59 upon disengagement of the switch-  
2 engaging arm 41 of the bolt support block 43 from the limit  
3 switch 59 on the previous occasion of lock opening.

4  
5 3-LOCK IN CLOSED STATE - See FIG.3c  
6

7 Upon reaching the lock position, electrical power to the  
8 motor 23 is cut off and maintained off by the engagement of  
9 the switch-engaging arm 41 of the bolt support block 43 with  
10 the limit actuating switch 59, thus opening the normally  
11 closed contacts 57. This switch engagement also closes the  
12 normally open contacts 61 of the limit switch 59 and so  
13 provides power to the Lock light 63.

14 The arm of the toggle switch 51 can then be returned to  
15 its normal center-off position. This return-to-center switch  
16 action opens the normally open contacts 53 and 55 and so  
17 further removes electrical power from the D.C. motor 23.  
18 Locking device electrical power is then turned off by  
19 activating the pushbutton power switch 33.

20 The normally open contacts 65 of the relay 31, which can  
21 only be closed by the GPS receiver 29 being on and its having  
22 determined that destination arrival has occurred,  
23 specifically assures that power is unavailable for driving  
24 the locking bolt 19 to its unlock position during the period  
25 from lock closing to destination arrival.

26 With the locking device now in the lock condition, a



1 transportable container 13 using the lock 15 of the present  
2 invention is ready for transfer to the preset destination  
3 location, with the lock being unopenable until the container  
4 has arrived and is located at the preset destination  
5 location.

6  
7 4-TRANSITION TO OPEN STATE - See FIG. 3d  
8

9 Upon arrival at the destination location, locking device  
10 electrical power can be turned on by activating the  
11 pushbutton power switch 33. This action turns on the GPS  
12 receiver 29, enabling it to determine its location and if it  
13 has arrived at the preset destination.

14 Upon confirmation of destination arrival by its  
15 calculation means, the GPS receiver 29 provides an output  
16 relay-actuating signal to the relay 31, thus closing the  
17 normally-open contacts 65 and 67. Closure of the contacts 65  
18 serves as the primary enabling function for subsequent lock  
19 opening by provision of electrical power to the D.C. motor  
20 23. Closure of the contacts 67 provides power to an Unlock  
21 Ready light 69, thus visually confirming to the locking  
22 device operator that lock opening can be performed by moving  
23 the arm of the toggle switch 51 to the unlock position.

24 Movement of the arm of toggle switch 51 to the unlock  
25 position makes available D.C. electrical power of the correct  
26 polarity (now reversed) through the now closed normally-open

1 contacts 71 and 73 of the toggle switch 51 and further,  
2 through the contacts 49 of the now-disengaged unlock limit  
3 switch 45. This set of contact closures provides power to  
4 the D.C. motor 23, enabling the motor to drive the locking  
5 bolt 19 out of the bolt-receiving block 21, thus unlocking  
6 the lock.

7 On completion of lock opening, the switch-engaging arm  
8 41 of the bolt support block 43 engages the limit switch 45  
9 at the unlock limit position, thus opening the normally  
10 closed contacts 49 and closing the normally open contacts 47.  
11 Opening the contacts 49 removes power from the D.C. motor 23.  
12 Closing the contacts 47 provides power to the Control Unlock  
13 light 39, thus providing visual confirmation of unlock status  
14 and that the toggle switch 51 may be returned to its center-  
15 off position.

16 As a result of unlock status confirmation, complete  
17 locking device electrical power may be turned off by again  
18 activating the pushbutton power switch 33 to open the  
19 contacts 35. The power-off action is visually confirmed at  
20 the control panel 27 by the turned-off Power On light 37.  
21 Such power removal will also turn off the Control Unlock  
22 light 39 and the Unlock Ready light 69. The lock will remain  
23 unlocked as long as locking device power remains off. The  
24 described embodiment of the invention provides for subsequent  
25 lock closing by turning electrical power on by activating the  
26 pushbutton power switch 33 and repeating the above described

1 sequence of operation.

2 It is obvious that many modifications and variations of  
3 the present invention are possible in light of the above  
4 teachings. For example, the coordinates of the preset  
5 destination may be entered by a remote encoded transmission  
6 of the data to the locking device after the lock has been  
7 closed and is being moved. Also, the locking device can be  
8 modified so that instead of being unopenable except at the  
9 preset site, it will be unclosable except at the preset site.  
10 Further, the method of determining the coordinates of the  
11 lock is not limited to the Global Positioning System, but may  
12 include the GLONASS System of satellites established by the  
13 U.S.S.R.; the GPS related location accuracy enhancement  
14 system referred to as the Differential GPS, or DGPS System;  
15 any of the radio wave systems, such as LORAN, generally used  
16 as electronic aids for aircraft and ship navigation; or any  
17 other manual or automatic electronic or optical, i.e., laser,  
18 system of sensor-based location determination. It is  
19 therefore to be understood that

20 the invention may be practiced otherwise  
21 than as described.

# ABSTRACT

A locking device for a transportable container. The locking device can only be opened when the container has arrived at its destination. The locking device includes a lock having a movable bolt, a motor for moving the bolt and inputs for connecting a power source to the motor. The locking device also includes a relay having isolated input and output circuits. The output circuit contains the motor and the power source inputs. The input circuit contains a Global Positioning System receiver. The Global Positioning System receiver determines the coordinates of the lock, compares them to those of the preset destination, and outputs a signal to the relay to supply power to the motor only when there is a match.

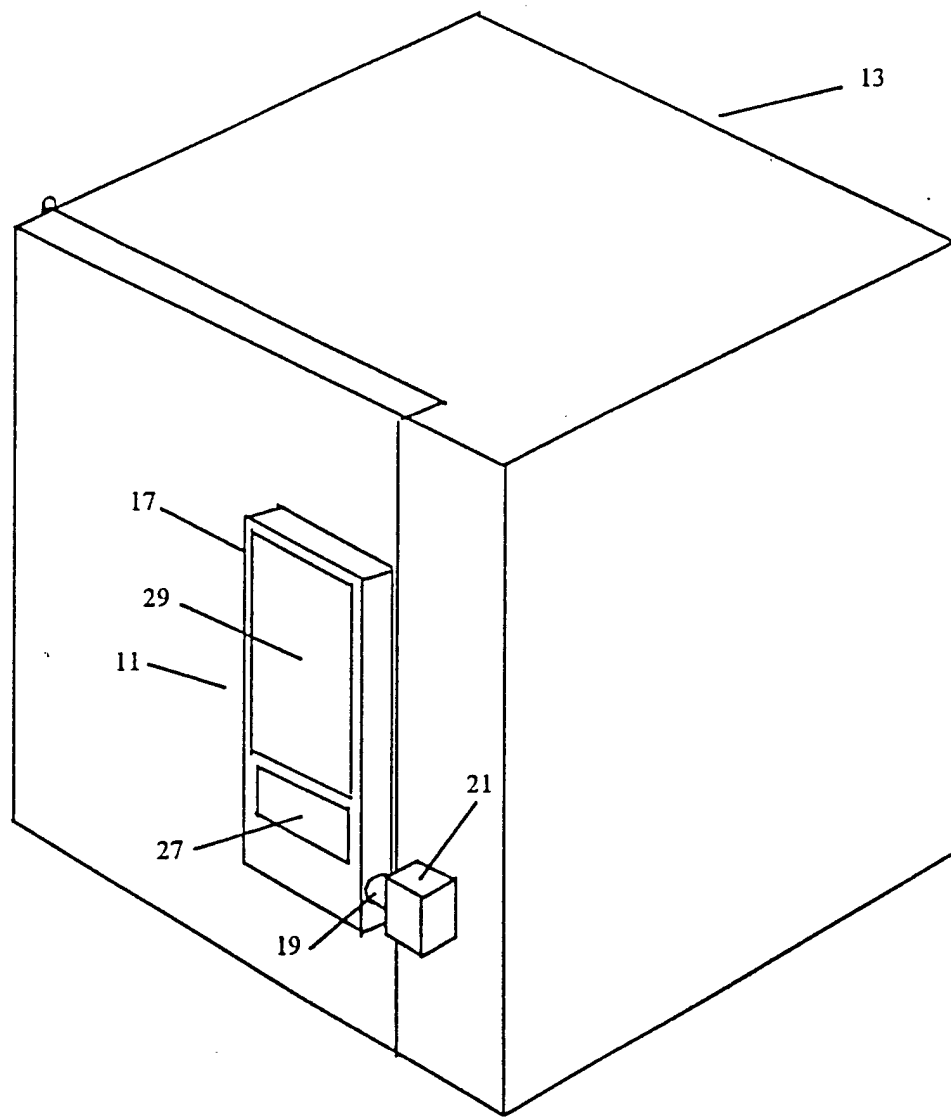


FIG. 1

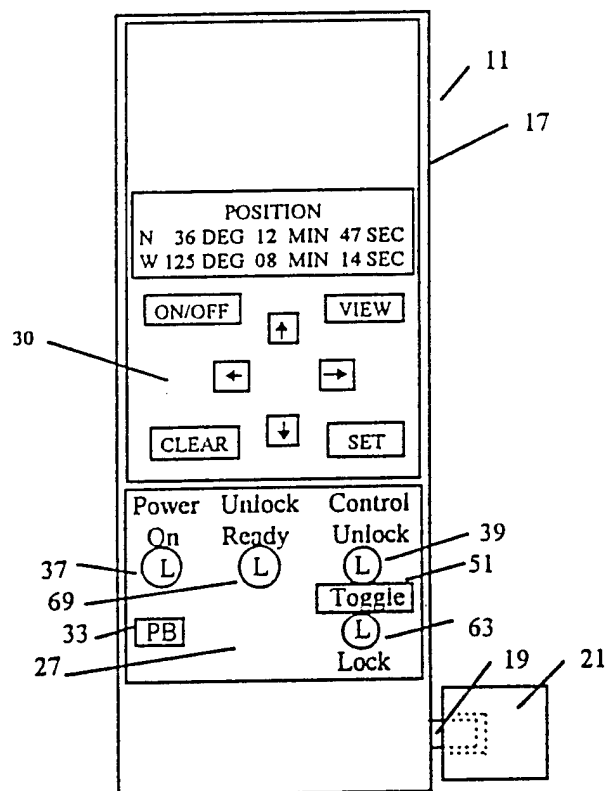


FIG. 2

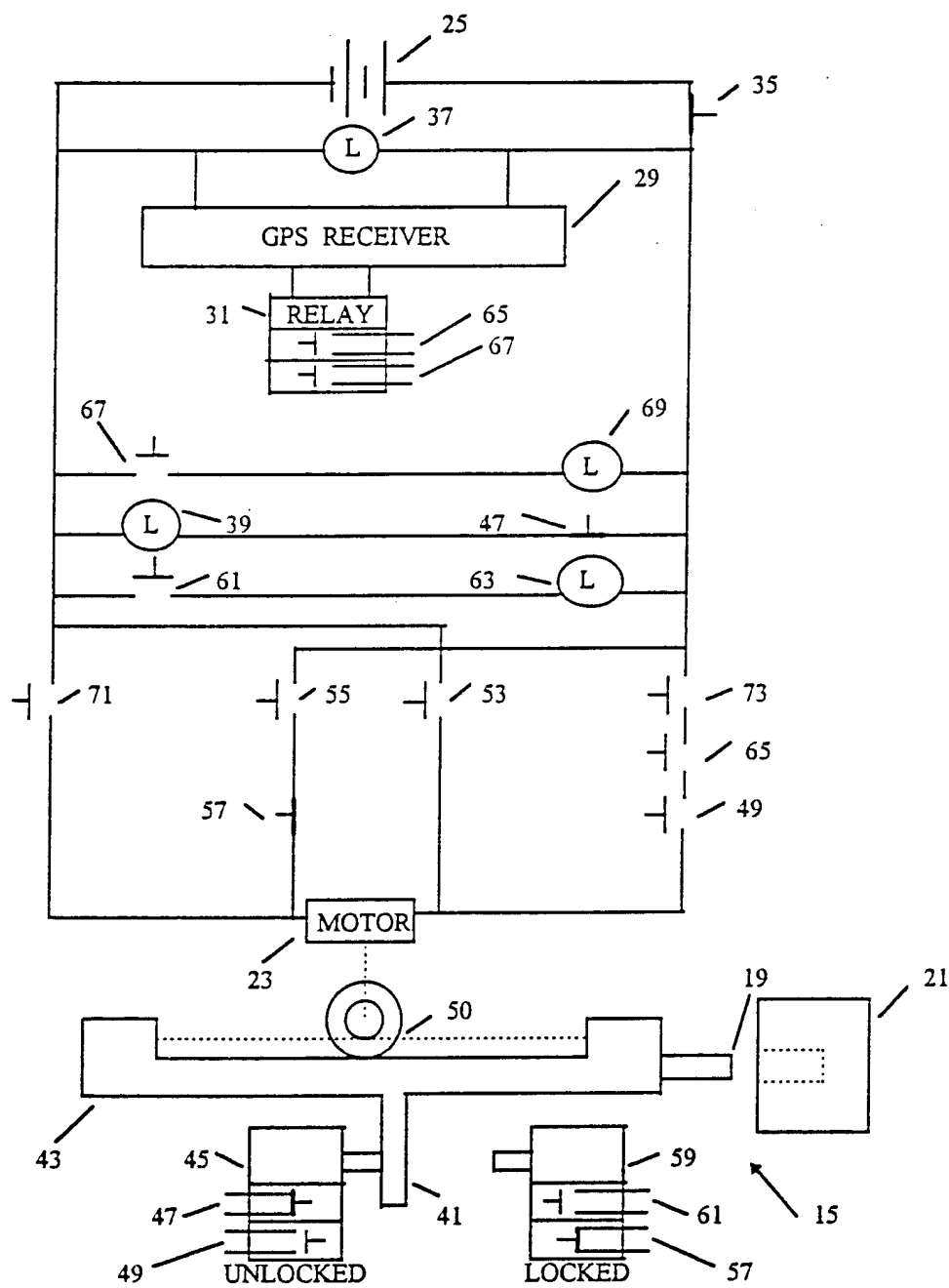


FIG. 3a

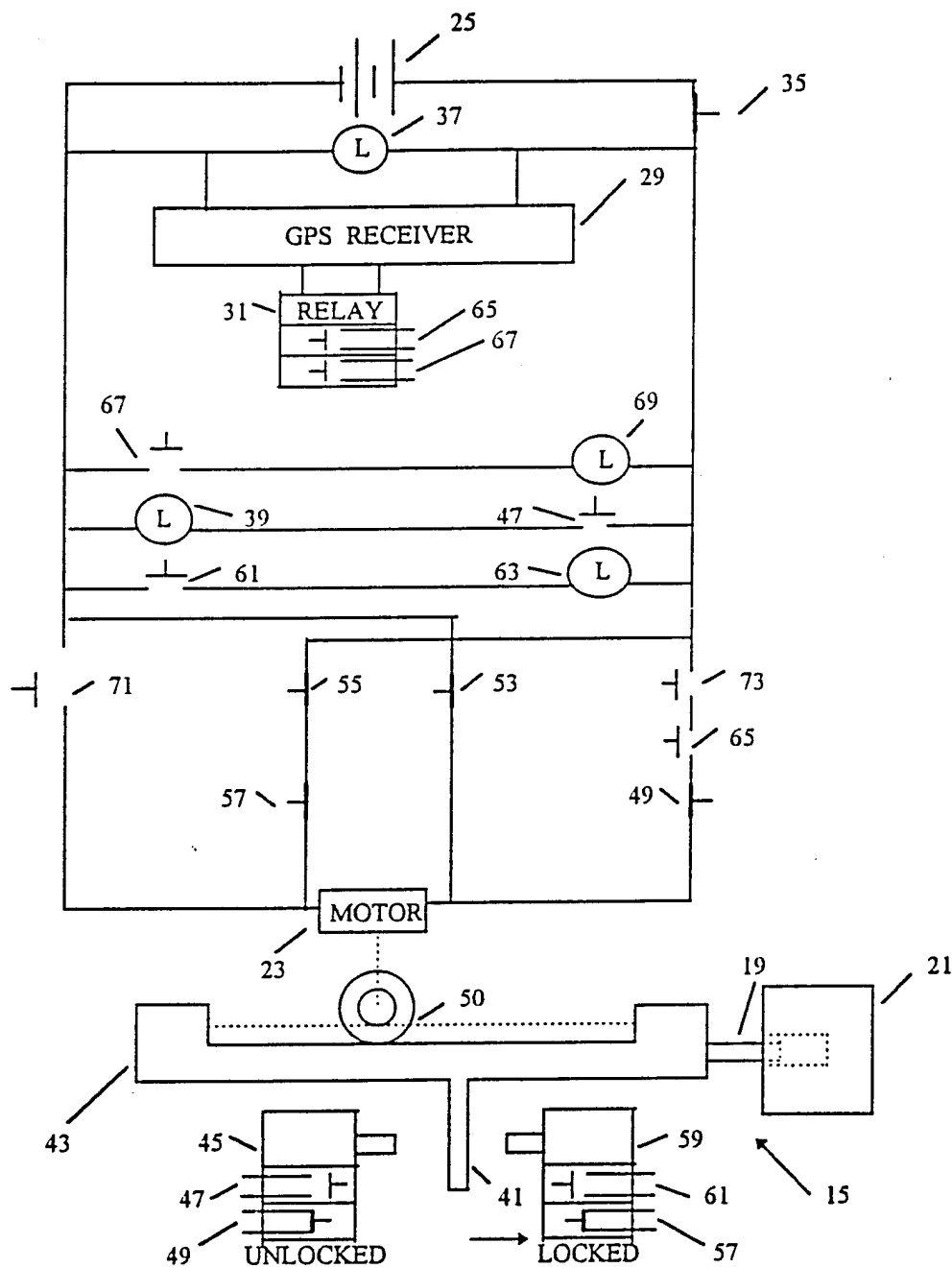
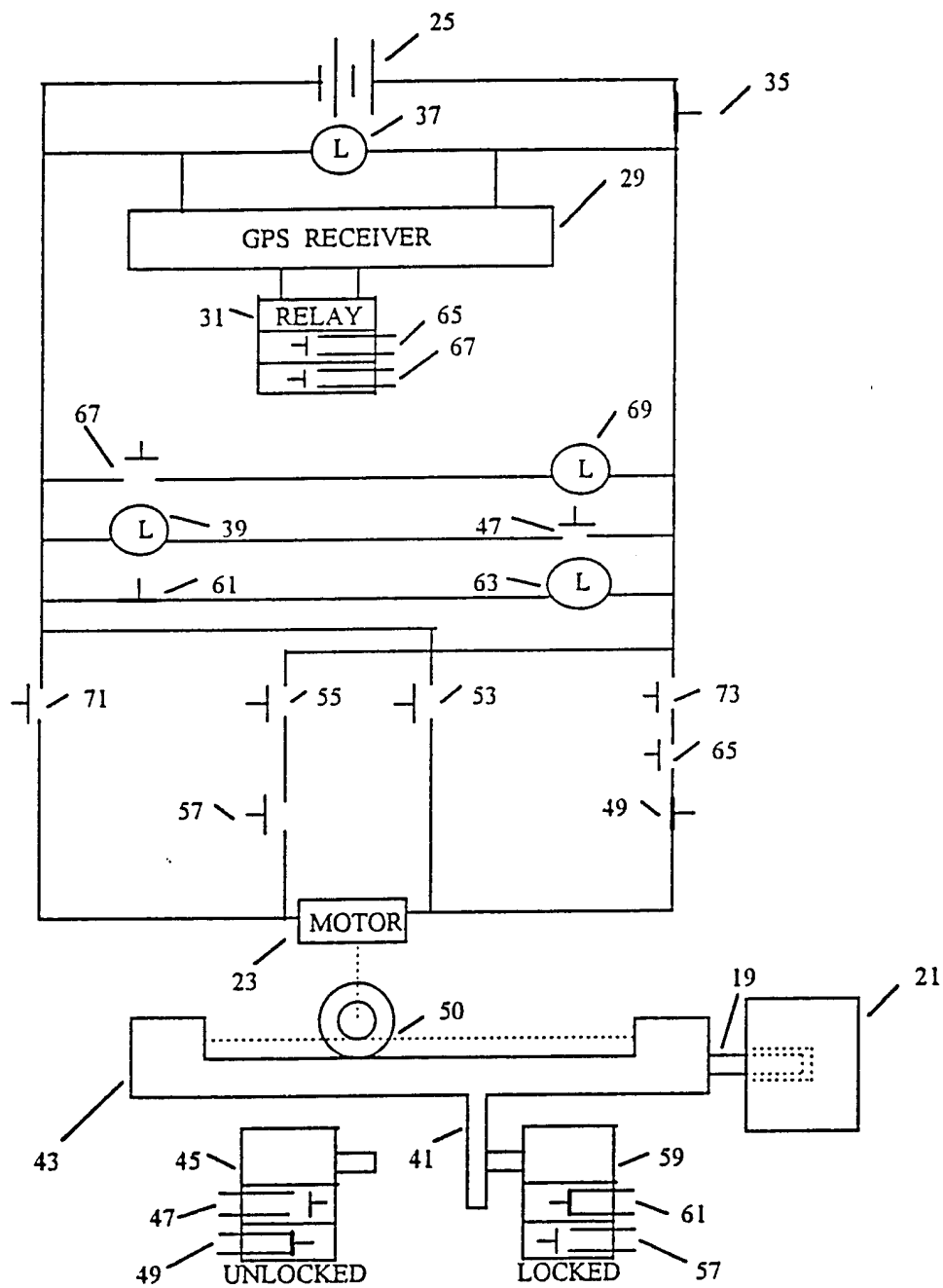


FIG. 3b





**FIG. 3c**

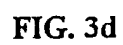


FIG. 3d